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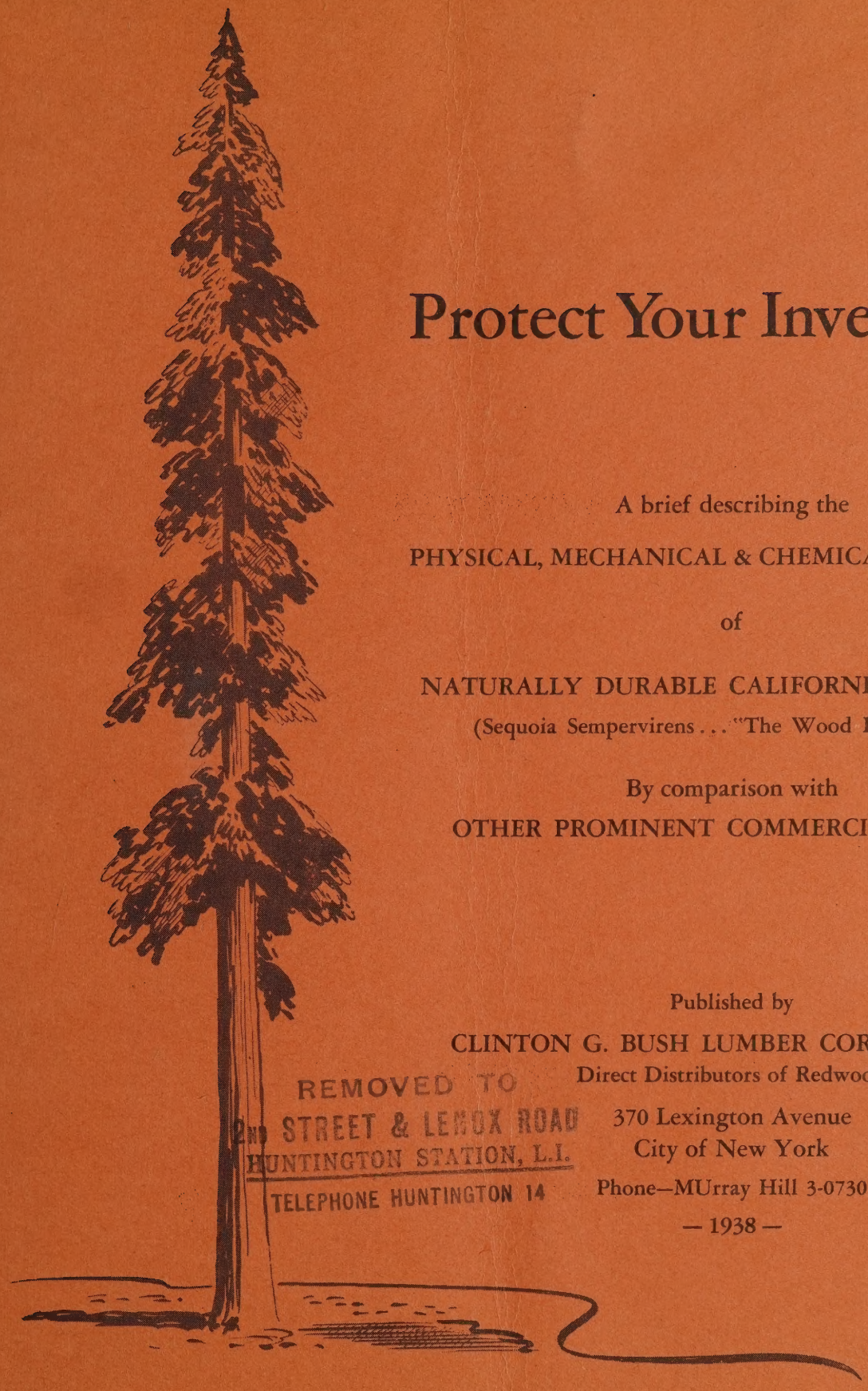

Protect Your Investment

A brief describing the

PHYSICAL, MECHANICAL & CHEMICAL PROPERTIES

of

NATURALLY DURABLE CALIFORNIA REDWOOD

(Sequoia Sempervirens . . . "The Wood Everlasting")

By comparison with

OTHER PROMINENT COMMERCIAL SPECIES

Published by

CLINTON G. BUSH LUMBER CORPORATION

Direct Distributors of Redwood

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Engineers and Architects appreciate that the technology of lumber is a voluminous subject, and from their findings recognize that enormous differences exist in the natural physical, mechanical, and chemical properties among the various species of lumber.

It is therefore of paramount importance that the utmost care be exercized in the selection of the species most adaptable for any given purpose.

With this thought in mind we are presenting herein an analysis of the primary properties that are relevant to the creation of structures of high durability and sustained beauty.

* * * *

The superior qualities of NATURALLY DURABLE CALIFORNIA REDWOOD are defined in comparison with other prominent commercial species.

The Latin name "sempervirens" (the commercial species) given to REDWOOD, literally means "ALWAYS LIVING".

REDWOOD is the largest and oldest living thing on the face of the earth.

For thousands of years, REDWOOD, has withstood fires, and the attack of the wood destroying parasites (such as fungi, termites, and other insects).

The distinguished ability of REDWOOD to endure the ages, is due to the inclusion by Mother Nature of her own chemical preservatives in each and every cell of its structure, (which are toxic to the destructive parasites), and the absence of the highly inflammable substances that most other species contain.

This treatise deals with the following subjects in the order named:

Section # 1. DURABILITY - (resistance to decay and rot).
Section # 2. STRENGTH and related properties.
Section # 3. SHRINKAGE and SWELLING.
Section # 4. WARPING, CUPPING, and TWISTING.
Section # 5. CHECKING, SPLITTING, and WEATHERING.
Section # 6. WORKABILITY.
Section # 7. PAINTABILITY.
Section # 8. GLUE HOLDING
Section # 9. NAIL and SCREW HOLDING.
Section #10. FIRE RESISTANCE.
Section #11. INSULATION.
Section #12. TERMITE RESISTANCE.
Section #13. AVAILABILITY.
Section #14. VERSATILITY.
Section #15. BEAUTY OF APPEARANCE.
Section #16. GENERAL USES.
Section #17. GRADES and SPECIFICATIONS.
Section #18. INITIAL COST.
Section #19. MAINTENANCE COST.
Section #20. SERVICE RECORDS.
Section #21. SUMMARY.

Prepared by Clinton G. Bush

1. DURABILITY
(resistance to decay and rot)

Decay and rot are directly attributable to the activities of parasites, such as fungi, termites, and other insects.

The lace-like plants, or cottony growths (fungi) may sometimes be seen on the surface of the lumber.

The spores of fungi are so small that they float long distances in the air. When one lights on a piece of wood, where conditions are favorable to growth, fungus begins it destructive action.

Wood destroying fungi are able to send their threads through the wood fibres - break down the cell walls and utilize portions of this decomposing material as food.

Lumber that is exposed to the elements under alternating wet and dry - hot and cold atmospheric conditions is vulnerable to attack by these highly destructive parasites.

Note the end of the log - over which has grown a giant Redwood tree, 2,500 years old. The log is still sound and durable after laying on the ground for thousands of years. Mother Nature's own chemical preservatives protect this marvelous wood from attack by the wood destroying parasites.

The U. S. Department of Commerce, (Forest Products Division) in Bulletin #171 - (1937) says -

"Fallen trees have lain on the ground for hundreds of years, yet are so sound today, that when taken to the sawmill, they produce perfect sound lumber. Scientific investigations have shown that Redwood lumber possesses many peculiar properties which make it very durable - virtually an everlasting wood".

It also says - "Relatively few woods produced throughout the world possess as high a degree of resistance to decay and insect attack as California Redwood -- which according to actual service records is durable when used under conditions that favor decay" --

It further states - "Redwood has been exported to practically every civilized country of the world-tropical and semi-tropical, where climatic conditions are especially favorable to insect attack. It is under such conditions that Redwood proves its reputation of great durability".

The HEARTWOOD of all species is infinitely more durable than the sapwood. SAPWOOD contains a very rich store of food, readily soluble, and easily digested by fungi and insects.

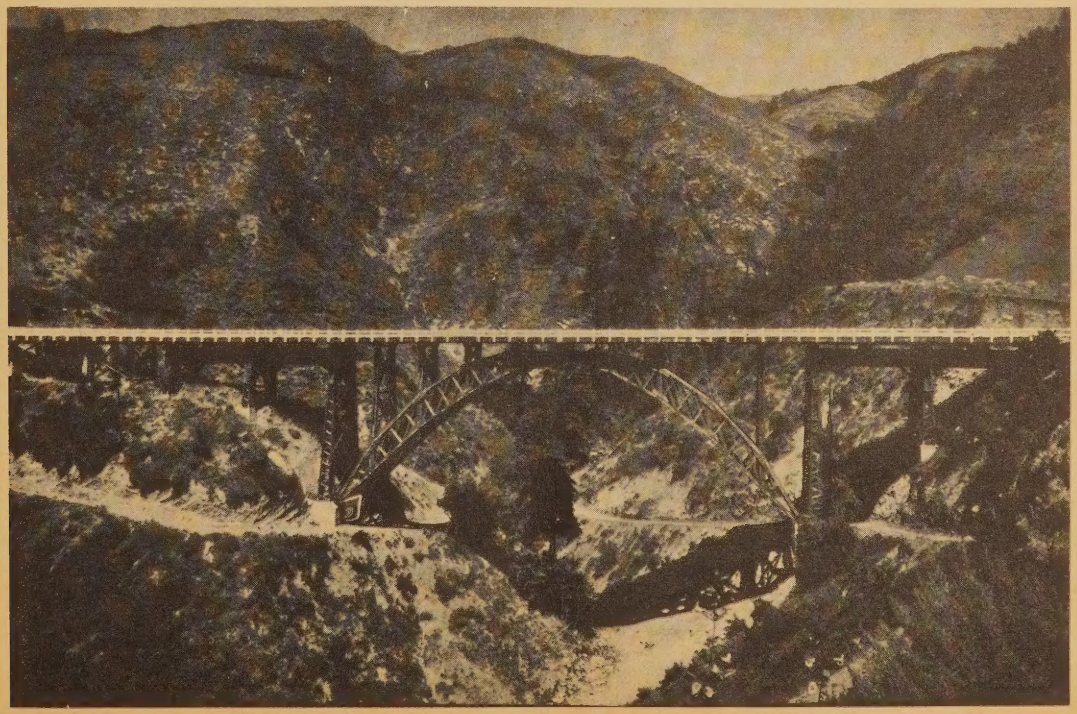
REDWOOD requires no artificial preservatives, as Mother Nature has impregnated CRESOL, PHENOL, and TANNIC ACID in each and every cell, not just on the surface, but right through to the core.

These natural chemicals in REDWOOD are toxic, or poisonous, to the low forms of plant and animal life that are so highly destructive, such as fungi and insects. This is the basic reason why REDWOOD is so impervious to decay and rot, and justly enjoys its reputation of "THE WOOD EVERLASTING".

The U. S. Department of Agriculture (Forest Products Laboratory) Hand Book, Sept. 1935 - Page #42, gives the following group ratings for durability on several species, based on the HEARTWOOD - unselected. A few commercial species are, as follows:

REDWOOD	- 1st Class
YELLOW PINE	- 3rd Class
DOUGLAS FIR	- 3rd Class
HEMLOCK	- 4th Class
SPRUCE	- 4th Class
OAK, Red	- 4th Class
ASH, White	- 4th Class
HICKORY	- 4th Class
MAPLE	- 4th Class

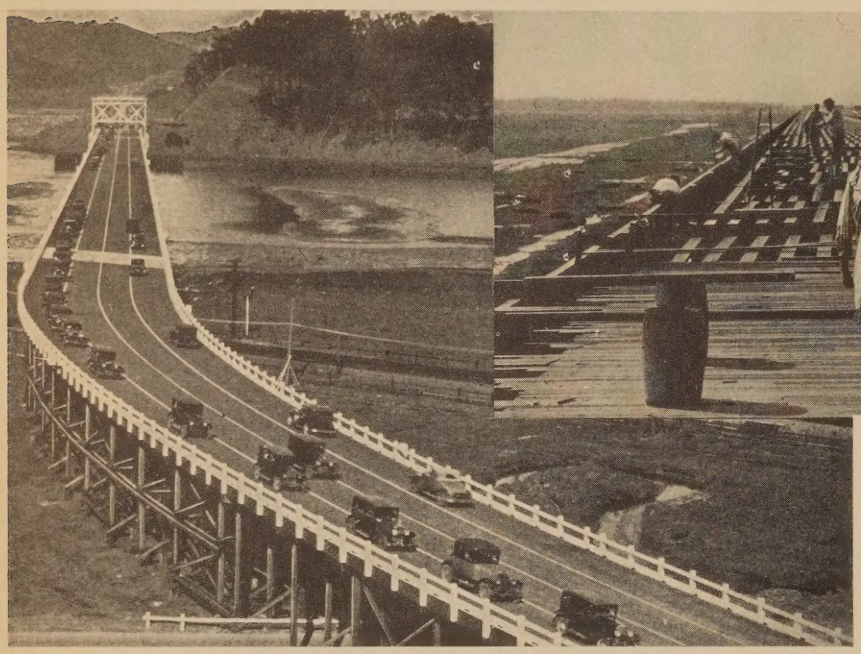
There are literally thousands of service records collected from every civilized country in the world giving definite proof of the outstanding and enduring properties of REDWOOD. (A few of them are annexed hereto - See Section 20).



The world's largest single span wooden bridge, built entirely of REDWOOD. This is one of 21 major spans in this project, erected at a cost far below that which would have resulted from the use of any other material.

2. STRENGTH
(and related properties)

The U. S. Department of Commerce, Bulletin #171, Page #11, says:
"Combining the desirable qualities of strength and natural durability, accounts for Redwood being extensively employed for many structural purposes, such as highway bridges, trestles, and mill roofs."



The Decking and Underpinning is built entirely of REDWOOD; as well as hundreds of other bridges and heavy traffic main highways. Engineers testify to the strength, durability, extremely long life, and economy of California REDWOOD.

The U. S. Department of Agriculture (Forest Products Laboratory) Technical Bulletin #479, Sept. 1935, gives the strength properties of species. We quote below a few of the commercial species, for your comparison.

Species	Redwood	Y. Pine	D. Fir	Spruce	Red Oak
Point of Shipment	(Cal.)	(N. C.)	(Wash.)	(Oregon)	(La.)
Annual rings per inch	33	11-4/10	15-1/10	15-3/10	10-4/10
Weight per cubic foot	51	55	35	31	67
Static Bending:					
Stress at prop. limit (# Sq.In.)	5030	3330	4540	3160	4370
Modulus of rupture (# Sq.In.)	7640	7500	6890	4920	8120
Modulus of elasticity (1# Sq.In.)	1178	1505	1411	1092	1474
Work to prop. limit (# Cu.In.)	1.33	0.43	0.85	0.53	0.75
Work to maximum load (# Cu.In.)	7.5	8.8	6.6	5.4	9.8
Impact Bending:					
Stress at prop. limit (# Sq.In.)	9310	8300	11600	7810	10250
Work to prop. limit (# Cu.In.)	3.4	2.7	4.5	2.7	3.3
Compression Parallel to Grain:					
Stress at prop. limit (# Sq.In.)	3780	2140	no rat.	1920	2680
Max. crushing strength (# Sq.In.)	4290	3480	3470	2180	3460
Compression Perpendicular to Grain: (# Sq.In.)	524	425	471	222	682
Shear, Parallel to Grain (maximum shearing strength) (# Sq.In.)	798	878	849	696	1053

The U. S. Government has compiled a table of wood strengths, comprising 139 varieties of Hardwoods and Softwoods. REDWOOD is classified as "strong" in this tabulation. There is no wood in the entire list classified as stronger than REDWOOD, that is not at least 34% heavier.

STRUCTURAL DATA

The U. S. Department of Agriculture(Forest Products Laboratory) Hand Book, Sept. 1935, Page #105, lists the following ratings for DURABLE MATERIAL, as well as NON-DURABLE MATERIAL - unselected:

"WHEN USED UNDER CONDITIONS THAT DO NOT FAVOR DECAY"

Durability Class Rating	Redwood 1st	Spruce 4th	Y. Pine 3rd	D. Fir 3rd	Red Oak 4th
Extreme fiber in bending	1,707	1,466	2,000	2,000	1,866
Compression parallel to grain	1,422	1,066	1,466	1,466	1,333
Compression perpendicular to grain	267	250	325	325	500
Shear parallel to grain	93	113	146	120	167
Modulus of elasticity (M)	1,200	1,200	1,600	1,600	1,500

The U. S. Department of Agriculture (Forest Products Laboratory) Hand Book, Sept. 1935, Page #106, says, under heading:

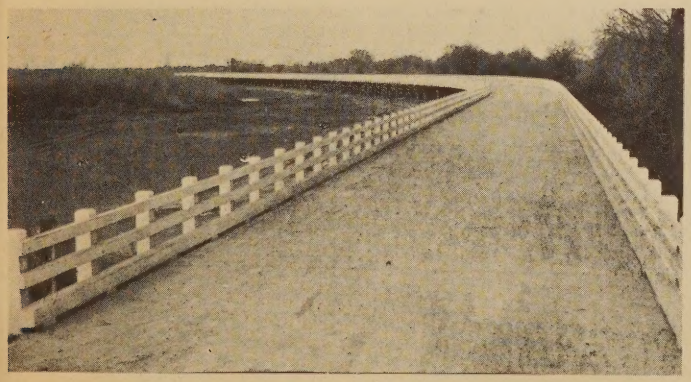
"TIMBERS USED UNDER CONDITIONS FAVORABLE TO DECAY"

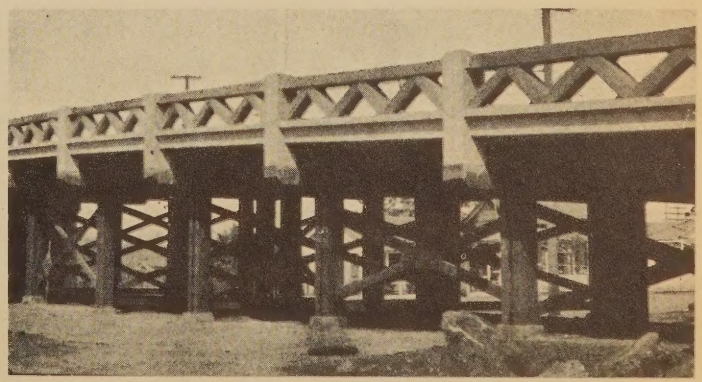
> "Allowance for the resulting deterioration is advisable. This may be accomplished by increasing the size of the members, either arbitrarily or through the lowering of design stresses."

Applying the formula recommended by the U. S. Department of Agriculture (Forest Products Laboratory) Hand Book, Sept. 1935, Page #107 - for obtaining equalizing working stresses, where decay hazard exists, we are listing below the following working stresses for lumber - -

"WHEN USED UNDER CONDITIONS FAVORING DECAY"

	Redwood	Spruce	Y. Pine	D. Fir	Red Oak
Extreme fiber in bending	1,212	416	852	852	530
Compression parallel to the grain	1,109	333	686	686	416
Compression perpendicular to grain	155	58	113	113	116
Shear parallel to grain	93	45	88	72	66
Modulus of elasticity	1,200	480	960	960	600





REDWOOD requires no paint as a preservative, however, should painting be desired, paint lasts much longer on REDWOOD than other species. The natural beauty of REDWOOD for Posts and Rails (unpainted) blends harmoniously with rustic surroundings. It has great durability, and the minimum of checking and weathering.

3. SHRINKAGE & SWELLING
(contraction & expansion)

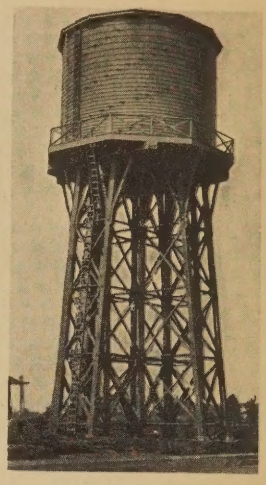
This factor is one of most vital importance to insure a "STAY-PUT" tight job. The natural shrinkage of most species is remarkably large, and after the lumber is fitted into place, it shrinks or "draws", pulling against its fastenings and causes the joints to open. (This also has a very direct bearing on the insulation value as discussed later in Section 11).

Shrinkage is the direct cause of the contraction of the cell walls. As the moisture evaporates, the fibrils become deflated in size, decreasing the dimensions. Another factor that influences the degree of shrinkage is its density, that is to say, the actual amount of wood substance by volume - (See comparative chart of annular rings per inch under Section #2).

The U. S. Department of Commerce in Bulletin #171, Page #12, says:

> "Another outstanding quality of Redwood, which makes it so desirable for both outdoor and interior purposes is its low shrinkage, or swelling, under variable conditions of moisture -- where it is subject to rain one day and sunshine the next, it has been found to stay in place well, with little, if any tendency to warp or split."

The U. S. Department of Agriculture (Forest Products Laboratory) Hand Book, Sept. 1935, Page #196, charts the shrinkage of 68 various species of lumber grown in the United States. "Shrinkage-volumetric from green to air dried 12% to 15% moisture content." This corresponds reasonably to the average atmospheric conditions.

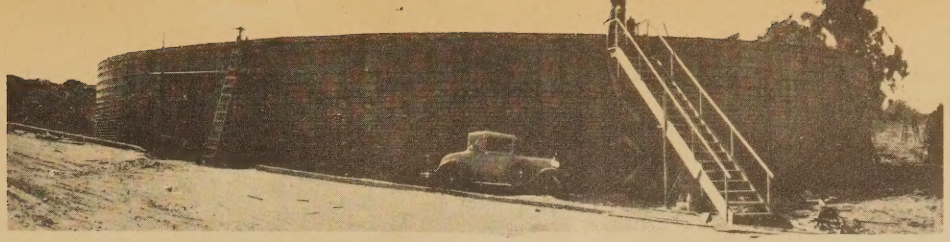


REDWOOD is used extensively for water tanks and towers.

REDWOOD HAS THE LOWEST PERCENTAGE OF SHRINKAGE OF ALL 68 SPECIES TESTED - 3-4/10%

SPECIES	Shrinkage	More than Redwood	SPECIES	Shrinkage	More than Redwood
W. White Pine	5-9/10%	73%	Tupelo Gum	6-2/10%	82%
Douglas Fir	5-9/10%	73%	E. Spruce	6-3/10%	85%
W. Hemlock	6-0/10%	76%	Larch	6-6/10%	94%
Long Leaf Y. Pine	6-1/10%	79%	Maple, Sugar	7-4/10%	117%
Short Leaf Y. Pine	6-2/10%	82%	Red Oak	7-4/10%	117%
Poplar	6-2/10%	82%	White Oak	8-0/10%	135%

The largest pickle storage unit in the world. Equipped with 475 REDWOOD tanks, each containing approximately a carload of pickles; in use for over 20 years. (Photo shows only the tops of the tanks, that protrude above the floor level) REDWOOD is universally accepted and used as the ideal tank material.



This is the largest wood tank in the world - REDWOOD - inside diameter 130 ft., height 18 ft. Capacity 1,700,000 gallons.

4. WARPING, CUPPING & TWISTING

It is highly important that lumber when put in place, "STAYS-PUT", therefore, the significance of these three factors are of far reaching concern.

The two (2) major motivating powers that create warping, cupping, and twisting, are SHRINKAGE (see comparative table #3) and the degree of straightness of grain. REDWOOD is one of the STRAIGHTEST GRAIN woods in the world.

The U. S. Department of Agriculture, Hand Book, Sept. 1935, Page #41, says under the heading -

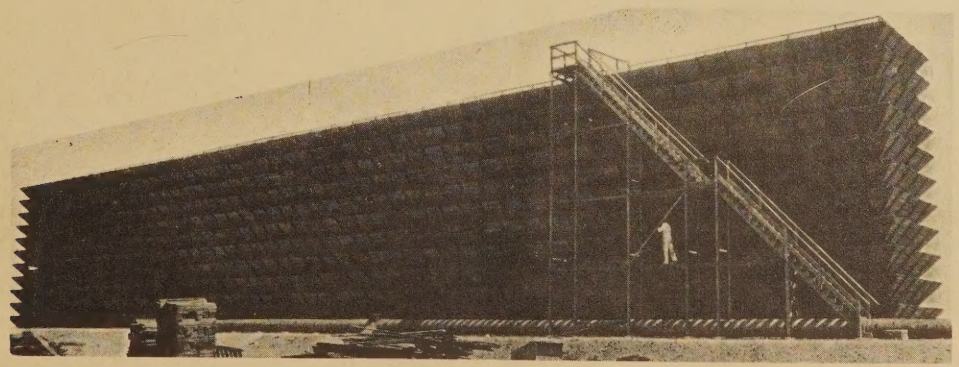
"WOODS THAT CUP AND TEND TO PULL LOOSE FROM FASTENINGS WHEN EXPOSED TO THE WEATHER"

REDWOOD is rated	-	"SLIGHT" (the top bracket rating)
SPRUCE is rated	-	"Distinct"
YELLOW PINE is rated	-	"Distinct"
DOUGLAS FIR is rated	-	"Distinct"
PONDEROSA PINE is rated	-	"Distinct"
WHITE PINE is rated	-	"Distinct"
OAK, White & Red is rated	-	"Very Pronounced"

5. CHECKING and SPLITTING

Checking and splitting are primarily caused by seasoning and weathering. Here again shrinkage plays an important role. As the lumber expels its moisture in the process of drying, it shrinks, resulting in bisecting or disuniting the cellular structure. This produces openings parallel to the grain, called checks and splits. This is often amplified by the degree of crooked or deflected grain.

Checks and splits not only impair appearance, but these crevices offer quite an inviting harbor for destructive fungi and insect life - very particularly so in non-durable species.



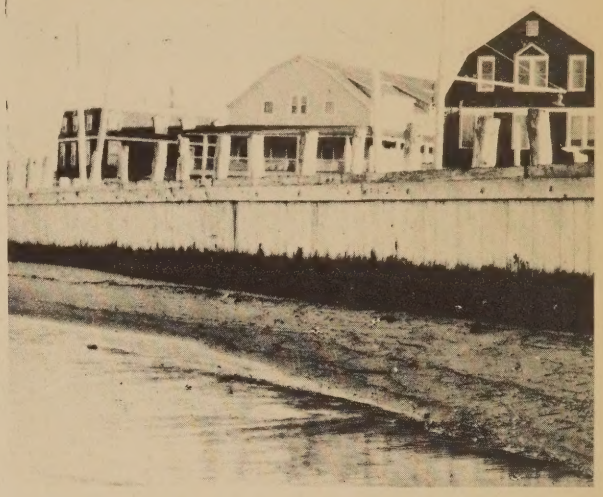
Cooling tower manufacturers insist upon REDWOOD . Years of service records justify its continued use. REDWOOD cooling towers are shipped to all parts of the civilized world.

Architects and Engineers recognize the importance of this factor and give careful consideration to species carrying a high percentage of shrinkage, (which causes splitting and checking) by either increasing the size of the members, or reducing the working stress co-efficient as recommended by the U. S. Department of Agriculture (Forest Products Laboratory) Hand Book, Sept. 1935, Page #113.

It is therefore important to specify a low shrinkage straight grained species for sustained satisfaction.

The U. S. Department of Agriculture (Forest Products Laboratory) Hand Book, Sept. 1935, Page #40 divides weather checks into two (2) classifications - "Conspicuous" and "Inconspicuous", and rate the species as follows:

REDWOOD	-	"Inconspicuous"
SPRUCE	-	"Conspicuous"
YELLOW PINE	-	"Conspicuous"
DOUGLAS FIR	-	"Conspicuous"
PONDEROSA PINE	-	"Conspicuous"
WESTERN WHITE PINE	-	"Conspicuous"
OAK, Red and White	-	"Conspicuous"



Redwood is extensively employed for Bulkheads and Shoring, due to its high durability and low weathering.

This is a 52" continuous stave pipe line of REDWOOD, built for the Anaconda Copper Mining Co., at Georgetown Lake, Montana. Engineers insist on a wood of high durability, with low shrinkage, to secure a tight, long lasting job. That is why they specify REDWOOD. Thousands of miles of REDWOOD pipe have been installed within the past 50 years and service records testify to no repairs.

6. WORKABILITY

The ease with which REDWOOD works is an item for consideration.

The U. S. Department of Commerce in Bulletin #171, Page #13, says:

> "In selecting a wood for a given purpose the ease with which it may be worked is sometimes an important factor. The Forest Products Laboratory classes redwood in the "medium group" of woods with regard to ease of working with hand tools."

7. PAINTABILITY

The value of selecting a wood with high paint-holding qualities should be measured, not only from the phase of beauty of appearance, but from the lasting protection to the lumber from the elements, and particularly the low cost of maintenance.

The U. S. Department of Commerce, Bulletin #171, Page #14 says:

> "Although Redwood is naturally a very durable wood, suitable for outdoor use in an unpainted condition, there are many occasions when painting is desirable from the aesthetic sense -- official painting tests made on Redwood, of a quality commonly used for siding or millwork, places it in the group of woods that hold paint longest, and suffer least when protection against weathering becomes inadequate."

The U. S. Department of Agriculture (Forest Products Laboratory) Hand Book, Sept. 1935, says: (extracts and page numbers follow) --

> "Ordinary paints and varnishes are not effective as preservatives against fungus decay." (Page 227)
>
> "When coating has become embrittled with age, differences between woods become very important, and very largely determine how rapidly the coating disintegrates." (Page 229)
>
> "The wider the bands of summerwood intersected by the paint surface the more rapidly disintegration proceeds, and the more conspicuous the areas laid bare." (Page 230)
>
> "Narrow ringed wood holds coatings longer than wide ringed wood, because the bands of summerwood are narrower." (Page 230)
>
> "Coatings begin to fail to protect wood against weathering when deep fissures develop. The consequences of inadequate protection depend unpon the characteristics of the wood." (Page 230)
>
> "Woods that hold their shape well and do not develop conspicuous checks or cracks on weathering, are less seriously effected by the inadequacy of paint protection than other woods." (Page 231)
>
> "Piny resins consist of a solid rosin and a volatile liquid such as turpentine. They effect paint UNFAVORABLY by exuding through coatings, leaving unsightly encrustations." (Page 231)
>
> "Other extractives in wood may have a FAVORABLE effect on the durability of paint. There is evidence that such is the fact with extractives in Redwood --." (Page 231)
>
> "Wood should not be painted when it is wet." (Page 237)

"The conventional procedure in painting new wood surfaces calls for the application of three (3) coats of paint." (Page #237)

"Warped and checked boards are not restored by paint." (Page #239)

"Architectural design sometimes calls for the appearance of weather beaten wood. For weathered construction it is advisable to choose woods that weather with the minimum of cupping, twisting, and conspicuous checking." (Page #242)

Page #231 - classifies the physical properties of softwoods (conifers) for paint durability. This table gives four (4) group ratings - A few of the commercial species follow:

"WOODS THAT HOLD PAINT LONGEST AND SUFFER LEAST, WHEN PROTECTION AGAINST WEATHERING BECOMES INADEQUATE"

Species:	Class Group	Species:	Class Group
Redwood	#1	Hemlock (E & W)	#3
Northern White Pine	#2	Larch (W)	#4
Ponderosa Pine	#3	Douglas Fir	#4
Spruce (E & W)	#3	Southern Yellow Pine	#4

The U. S. Department of Agriculture does not give us any paintability class ratings on Hardwoods - but inasmuch as Hardwoods shrink, check, warp, twist, and split so badly - these factors would tend to break the paint film quickly. It is therefore reasonable to assume that they would rate in the lowest class.

8. GLUE HOLDING

The U. S. Department of Commerce, Bulletin #171, Page #14, says:

"Many beautiful architectural details have been achieved with Redwood. In manufacturing such products, not only is a wood with good woodworking qualities essential, but one with satisfactory glue holding power. The Laboratory classes Redwood in a group of relatively few woods thar glue easily with different glues, under a wide range of gluing conditions."

The U. S. Department of Agriculture (Forest Products Laboratory) Hand Book, Sept. 1935, Page #169, says:

"A species is considered to be glued satisfactorily when the strength of the joint obtained is approximately equal to the strength of the wood."

The U. S. Department of Agriculture makes four (4) group ratings; a few of them as follows:

REDWOOD	-	1st Group
SPRUCE	-	1st Group
YELLOW PINE	-	2nd Group
DOUGLAS FIR	-	2nd Group
PONDEROSA PINE	-	2nd Group
OAK	-	3rd Group
GUM	-	4th Group

9. NAIL & SCREW HOLDING

The U. S. Department of Commerce, Bulletin #171, Page #13, says:
"Many years of experience have demonstrated that Redwood has very satisfactory nail-holding power. Redwood is in the group of important woods with relatively high resistance."

Redwood interiors lend grace and charm, not only to Living Rooms, but to Dining Rooms, Libraries, Dens, and Play Rooms.

Paneling up tO 30" wide can be easily obtained.

Millwork to standard or special architectural details.

Paneling up to 30" wide can be easily obtained.

Millwork to standard or special architectural details.

The U. S. Department of Agriculture (Forest Products Laboratory) Hand Book, Sept. 1935, Page #123 for Nails -- Page #127 for Screws, gives the following lateral resistance ratings:

SOFTWOODS		HARDWOODS	
Specie	Group No.	Specie	Group No.
REDWOOD	#2	RED OAK	#1
SPRUCE	#3	WHITE OAK	#1
PONDEROSA PINE	#3	BASSWOOD	#3
DOUGLAS FIR	#1	POPLAR	#3
YELLOW PINE	#1	CHESTNUT	#3

In exposed usage be sure to specify a nail or screw whose durability is equal to that of the wood. Ordinary steel nails should not be used for exterior work. In such places a good hot dipped galvanized nail is a minimum requirement. Ordinary nails will cause loosened fastenings and rust stains.

10. FIRE RESISTANCE

The U. S. Department of Commerce, Bulletin #171, Page #17, says:

"The absence of resins or gums, in Redwood, makes it a naturally fire resistant wood -- from actual cases where intense fires have destroyed industrial plants, Redwood tanks, and laminated roofing, and walls, have escaped with only superficial charring."

The U. S. Department of Agriculture have no official tests depicting the ratings of various species, by comparison, but it is common layman knowledge that pitch or resinous matter is highly inflammable.

REDWOOD -- contains no pitch or resin, and is naturally a fire resistant wood. It is very slow to ignite, even under forced draft, burns very slowly and extinguishes quickly when flame is taken away from it.

Yellow Pine, Douglas Fir, Spruce, Ponderosa Pine, and Oak, all contain pitch or resinous substance, and therefore are highly inflammable.

Log Cabin Siding (1/2 Round) for this retreat. REDWOOD offers all types of Siding; Bevel, Bungalow, Drop, Novelty, Shingles, or Board and Batten.

11. INSULATION

The U. S. Department of Commerce, Bulletin #171, Page #17, says:

"Wood possesses the best insulating properties of any of the basic structural materials now commonly used. According to tests made by the University of Minnesota on the thermal conductivity of the more important commercial woods, Redwood ranked among those having the highest insulating values."

Insulation should not be judged solely by its thermal conductivity (B.T.U.) value, but the shrinkage factor must also be considered, as a great deal of heat and cold will naturally escape through the spaces resulting from the openings of the joints, attributable to shrinkage.

The LOWER the figures (both B.T.U. and shrinkage) the GREATER the value.

	B.T.U.	SHRINKAGE
REDWOOD	0.75	3-4/10%
YELLOW PINE	0.96	6-2/10%
DOUGLAS FIR	0.77	5-9/10%
SPRUCE	no rating	6-3/10%
RED OAK	1.18	7-4/10%

The American Society of Heating & Ventilating Engineers have supplied B.T.U. ratings.

12. TERMITE RESISTANCE

The Department of Commerce, Bulletin #171, Page #11, says:

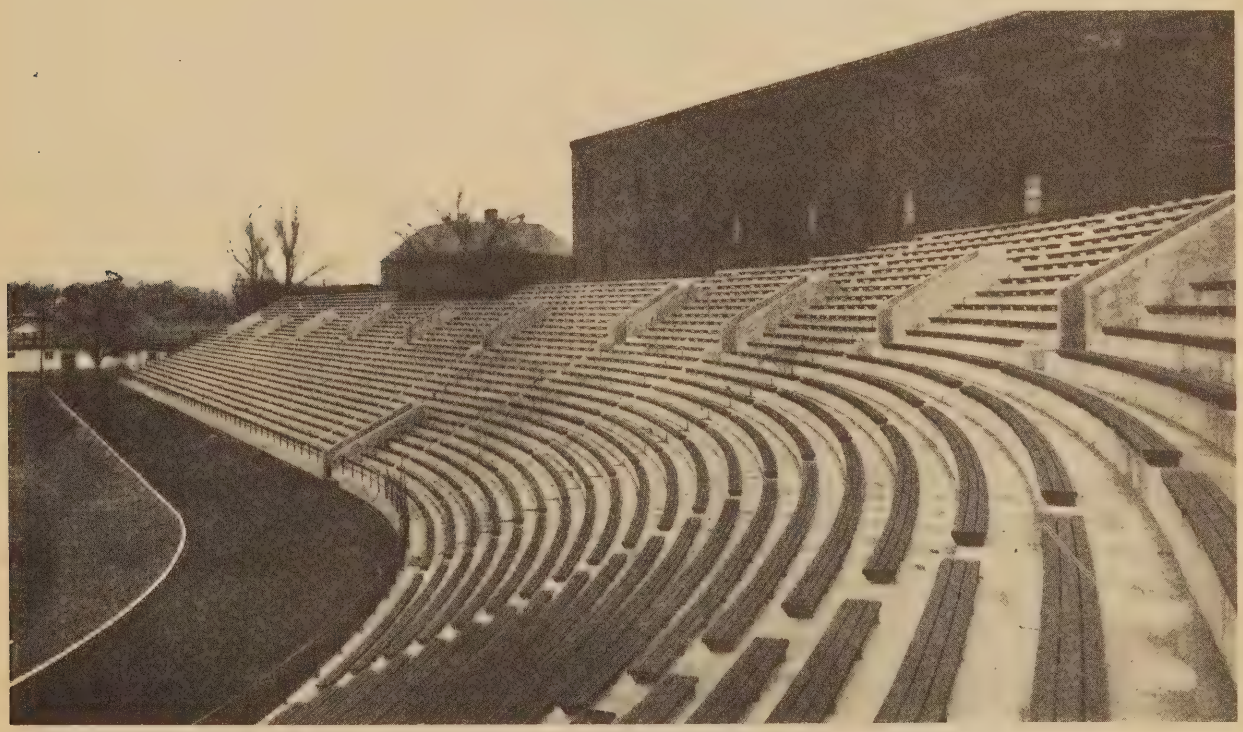
> "Redwood is one of the most termite resistant woods produced in the United States. This is verified by actual tests by the Bureau of Entomology of the U. S. Department of Agriculture."

Dr. James A. G. Rehn, Curator of the Dept. of Entomology delivered a speech, which was published in the Philadelphia Inquirer on May 20, 1933. An excerpt of this speech (speaking of termites) is quoted below:

> "Creosote will stop him only for a time. He is a shrewd baby and can do things with creosote that would surprise the manufacturer --."

> "and they don't care what they work on. The hardest wood is just as easy for them as the softest. As a matter of fact, they prefer hard, expensive wood. The only wood they don't like is California Redwood, which is comparatively soft."

Dr. T. E. Snyder and James Zetek, Bureau of Entomology, and also the Wood Utilization Committee of the Department of Commerce classify REDWOOD as one of the most termite resistant woods. Its resistance to termites is recognized by the Panama Canal authorities, who now specify for use in their termite infested territory - the all heart grades of REDWOOD.



Architects specify REDWOOD (vertical grain) mostly 2 x 4" for stadium seats, due to its prominent "stay-put" qualities, such as Durability; Slow Weathering; Minimum of Checking and Grain Raising. Seating for the outstanding stadia of the country are of REDWOOD. Here are a few - Chicago White Sox, Standford Rose Bowl, Notre Dame, Northwestern, Michigan, Denver, Drake, and Penn State.

13. AVAILABILITY

The Redwood mills carry very large stocks on hand (approximately 300 million feet) so as to effect prompt shipment of orders.

Standing REDWOOD timber (sequoia sempervirens) - the commercial species - assures a sustained supply for well over 150 years. Moreover, continual natural and commercial reforestation is replenishing the supply.

Timber of this size is commonplace in REDWOOD.

14. VERSATILITY
(Sizes and Patterns)

Size is of little consequence. REDWOOD timbers up to 30"x30"-60 feet long can be produced.

Clear, 100% Heartwood and Structural grades offer no problem to these ultra modern mills.

REDWOOD is manufactured in all patterns of siding, frames, sash, doors, trim, gutter, ceiling, partition, shingles -- in fact, to any standard or special patterns as may be directed by the engineers, architects, for general building, structural, or industrial uses.

15. BEAUTY OF APPEARANCE

The U. S. Department of Commerce, Bulletin #171, Page #160, says:

> "Redwood is a close grained wood, the wood may also be described as even textured."

Quite apart from its other general superior characteristics and advantages, REDWOOD has the natural beauty and warmth of color that lends eye appeal to any structure.

16. GENERAL USES

REDWOOD is commonly used and specified for:

Industrial Items:

Wooden Tank Staves	Railroad Car Roofing	Structural Bridges
Pipe Line Staves	Railroad Car Siding	Structural Trestles
Cooling Towers	Greenhouse Parts	Pier Construction
Irrigation Troughs	Sign Boards	Pier Roofs
Expansion Joints	Decking	Mill Roofs
Boat Lumber	Turning Squares	Telegraph Poles
Battery Separators	Hot Bed Sash	Lighting Poles
Burial Caskets	Furniture	Telephone Cross Arms
Pattern Lumber	Irrigation Gates	Church Pews
Refrigerator Hold Lining	Greenhouse Bench	Fencing
	Railway Ties	

Building Construction Items:

Bevel Siding	Mouldings	Partitions
Drop Siding	Room Paneling	Beams
Bungalow Siding	General Millwork	Wainscoting
Log Cabin Siding	Shingles	Columns
Frames	Finish	Drain Boards
Sash	Posts & Rails	Cornices
Trim	Garage Doors	Veneer Panels
Shutters & Blinds	House Doors	Vertical Board & Batten Siding
Fencing	Porch Flooring	Beamed Ceiling

17. GRADES & SPECIFICATIONS

REDWOOD has a grade suitable for every use and purpose:

YARD GRADES	STRUCTURAL GRADES	COMMON GRADES
Clear, All Heart	Dense All Heart Structural	#1 Heart Common
"A" Grade	Select All Heart Structural	#2 Common
"B" Grade	Heart Structural	#3 Common

WE WOULD BE VERY GLAD TO ASSIST BY RECOMMENDING GRADES AND SPECIFICATIONS THAT WOULD SUIT THE PURPOSE FOR WHICH IT IS INTENDED.

18. INITIAL COST

The initial cost of REDWOOD is relatively comparable with other high class woods, and considerably lower than some species.

19. MAINTENANCE COST (and repairs)

Due to the very high natural, physical, mechanical, and chemical properties of REDWOOD, maintenance cost would be of the very lowest.

20. SERVICE RECORDS

There are literally thousands of service records which attest to and bespeak of the durability of structures that have been in existence for extremely long periods of time.

Space does not permit us to attach them to this brief, but we are listing a few below. Should you desire additional evidences, it would be our pleasure to furnish them to you.

A FEW SERVICE RECORDS ATTESTING TO THE DURABILITY OF CALIFORNIA REDWOOD

25,456 TELEGRAPH POLES (38 years of service) 99-9/10% satisfactory)

POSTAL TELEGRAPH-CABLE COMPANY

W. H. Richardson, Sup't of Construction, writes 2/9/27.
"Referring to your letter of January 21st, 1927, file H-S 5948 relative to the Redwood Poles in the line operated by this Company along the Santa Fe right of way between Mojave, California, and Albuquerque, New Mexico, a distance of 795.5 miles.

These poles are California Redwood, set in 1889 and after service of thirty eight years our inspection shows only twenty five poles out of a total of 25,456 poles to be replaced, a percentage of one-tenth of one percent.

The poles on this line measure 5x5" at the top, and 8x8" at the butt and now carry ten overland circuits. When the line was constructed we strung two 300 pound copper wires, but we now maintain four 300 pound circuits, five 210 pound circuits, and one 573 pound circuit.

This lead has oftentimes been referred to by our General Superintendent of Plant, J. J. Lynch, of New York City, as "A living monument to the California Redwood."

I do not know of anything further I can say as a testimonial for the California Redwood, as the above facts speak for themselves.

Yours very truly,
(Signed) W. H. Richardson
Superintendent of Construction"

50 MILES OF REDWOOD PIPE(18 to 46 years' service) 100% satisfactory

The Butte Water Company have over 50 miles of Redwood pipe in their system. 24 miles (24" and 28" pipe) was installed in 1892, the balance in 1899 to 1920. It is still supplying Butte with water -- and has had no repairs except where a tunnel caved in on it!

REDWOOD PIPE LINE INSTALLED DENVER, COLORADO, 1893 - 100% satisfactory.

Two REDWOOD pipe lines, purchased and installed in their city system in 1893 are still in service, without repairs and with no evidence of decay.

110,000 LINEAR FEET REDWOOD PIPE (24 years of service) - - - - - - 100% satisfactory.

30" diameter REDWOOD pipe purchased by the City of Lynchburg, Va., in 1904, is still operating with a record of 24 years' service, entirely free from repairs or replacements.

SEVERAL MILES REDWOOD PIPE (22 years of service) - - - - - - - - - 100% satisfactory.

22" diameter REDWOOD pipe was purchased in 1906 by Cerro De Pasco, at Le Fundision, Peru, for water supply. In 1916 they purchased a duplicate Redwood line. Both lines are still in service, with no repairs or upkeep.

41 YEARS IN TERMITE INFESTED TROPICS - - - - - - - - - - - - - - - - 100% satisfactory.

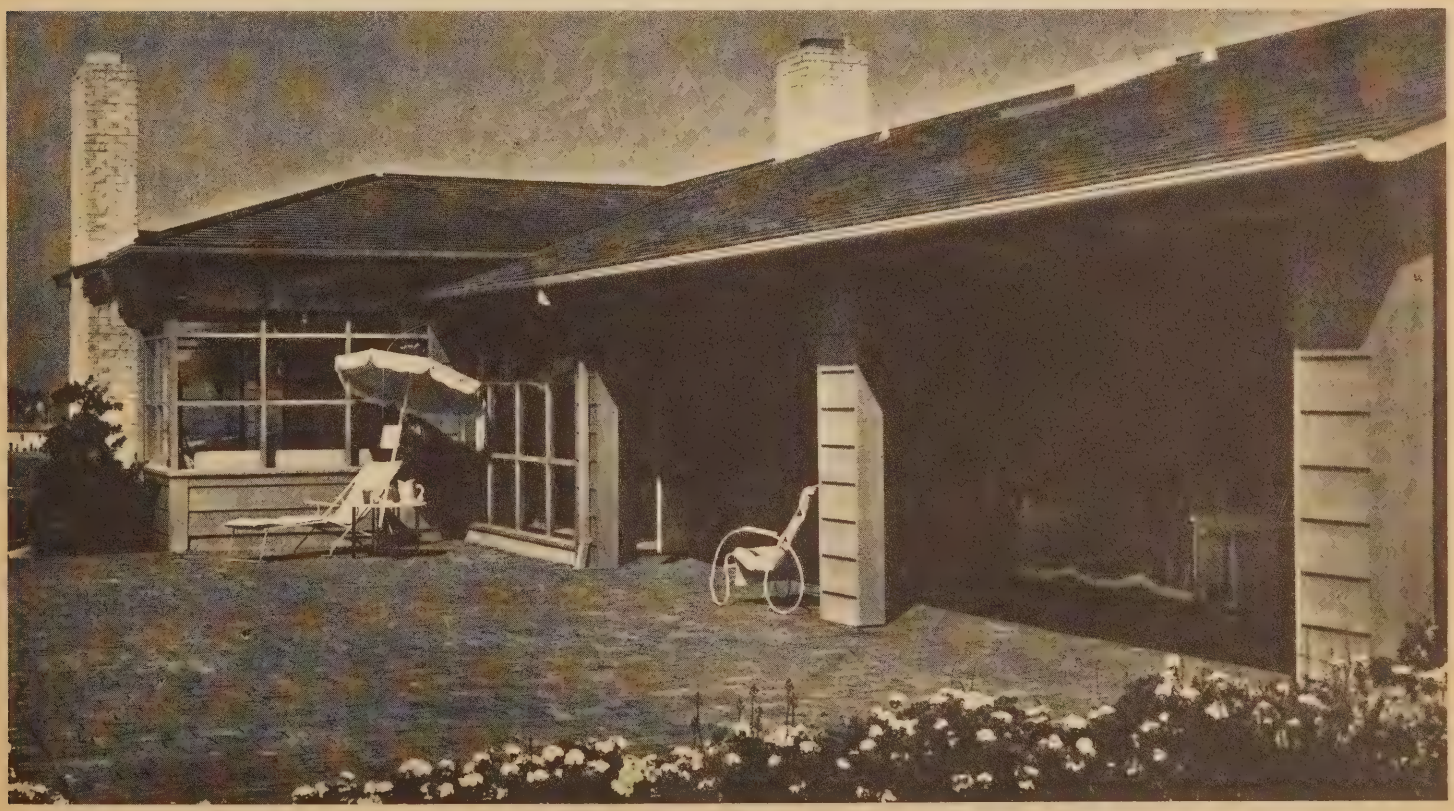
V. Hueso, writing from Santa Tecla, El Salvador, on January 2, 1927, says:

"My father used California Redwood lumber in the construction of buildings at the Port of La Libertad way back in the years of 1886 and 1887. The buildings, one of them the shipyards, can still be seen in use.

The white ants - a deadly enemy for lumber of all kinds - attacked and pulverized the pillars, which were of native hardwood lumber. They built nests on the Redwood beams, but did not penetrate them.

Proof of this is that the pillars have been changed over eight times, without a single piece of Redwood having been replaced for the reason that, to date, these are in perfect condition.

The name of this company is now the Agencia Salvadorena, and has just built a new warehouse with all the beam work being Redwood."



This cottage built entirely of REDWOOD overlooks the 168 year old Mission San Carlos Borromeo, which can be seen in the left background. REDWOOD was used in practically all the California missions.

44 YEARS IN TERMITE INFESTED PANAMA - - - - - - - - - - - - 100% satisfactory.

J. H. Stilson, Colon, Canal Zone, wrote on December 18, 1926:
"In 1883 the house shown in the attached picture was built entirely of California Redwood by Ward and Company for the French Canal Company. It was located where Gatun Locks now are. In 1892 I acquired the property and in 1907 I was obliged to tear it down to make way for Gatun Locks. The Redwood was found in excellent condition, neither decay nor white ants having attacked it, and the lumber was used again in the construction of other buildings.

Yours very truly,
(Signed) J. H. Stilson"

SEVERAL BRIDGES - - - - - - - - - - - - - - - - CONSTRUCTED 100% OF REDWOOD.

Letter from R. E. Donohoe, Deputy Assessor of Mendocino County, written on 11/22/24, states:
"Replying to your letter of the 14th instant, I will say that the bridge you mention (Big River Bridge) has been completed. It is a Howe Truss, two 120 foot spans, designed to carry a 20 ton road roller with a factor of safety of 6, and approximately 300 feet of trestle approach designed for the same load.

We also have the following bridges in this County that are constructed entirely of Redwood, to wit:

Navarro bridge constructed in 1912, Salmon Creek bridge constructed about 1913, Albion bridge constructed in 1922, Ten Mile River bridge constructed in 1914, and Leggett Valley bridge which spans south fork of Eel River, constructed in 1921. These are all large bridges and have given the very best of satisfaction, barring accidents, such as freshets, fires, etc. I feel satisfied that they will, with ordinary maintenance, last 40 years, or more. I base this statement on the fact that I have had occasion to remove old structures that had been in use for that long, some of them longer, and found the timber to be in first class condition.

We have a great many smaller bridges, all of which are made of Redwood, such as 40 and 60 foot spans.

I thank you for your offer as to information about Redwood and will avail myself of it at the first opportunity.

Very truly yours,
(Signed) R. E. Donohoe

21. SUMMARY

All prominent Architects and Engineers recognize the vital importance of determining the species of lumber best suited for the purpose intended.

They accomplish this by comparing the physical and mechanical properties of a selected list of species.

The natural characteristics embodied in REDWOOD justly entitle this species to its name - "THE WOOD EVERLASTING ".

As cited in this brief, REDWOOD possesses the HIGHEST RATING OF DURABILITY, and high STRENGTH properties, so essential in structures where resistance to decay is a factor.

REDWOOD has the LOWEST PERCENTAGE OF SHRINKAGE, which guarantees and insures a close fitting, "stay-put" job.

SHRINKAGE, being a major controlling factor, awards REDWOOD the HIGHEST RATINGS in WARPING, CUPPING, TWISTING, CHECKING, SPLITTING, WEATHERING, and PAINT LASTING QUALITIES.

The other outstanding qualities of REDWOOD are TERMITE RESISTANCE, FIRE RESISTANCE, GLUE HOLDING, INSULATION, and WORKABILITY.

The pleasing appearance of Redwood, coupled with its LOW INITIAL AND MAINTENANCE COST, together with its other qualifications, deserves and merits your favorable consideration.

The main technical information of this comparative chart, (as the captions indicate) was compiled directly from our most substantial and reliable source - THE UNITED STATES GOVERNMENT - and is OFFICIAL.

In our position as DIRECT REDWOOD DISTRIBUTORS we can serve you promptly and efficiently by shipments from California.

We also carry REDWOOD in stock at our LOCAL REMANUFACTURING MILL, and are in position to render punctual dispatch of orders.

Our large local facilities enable us to fabricate to any standard or special patterns, in accordance with your detailed specifications.

Should you desire any additional technical data, or any further information, we would deem it a pleasure to be of service to you.

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